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Epidemiological trends and modifiable risk factors for abdominal wall hernias in Saudi Arabia: A retrospective analysis of national hospital discharge data (2016–2023)

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Abstract

BACKGROUND: Abdominal wall hernias represent a significant and growing surgical burden globally. Modifiable risk factors including obesity, type 2 diabetes mellitus, smoking, and chronic respiratory disease offer meaningful targets for prevention-oriented interventions. Population-level epidemiological analyses characterizing hernia burden and associated risk factors in Saudi Arabia remain absent from the literature.

OBJECTIVES: This study aims to characterize the temporal trends in abdominal wall hernia repair procedures, describe the prevalence and distribution of modifiable risk factors among hernia patients, and assess geographic and urban–rural variations in hernia burden and surgical outcomes across Saudi Arabia.

METHODS: This cross-sectional descriptive study analyzed secondary data from the Saudi Ministry of Health Annual Statistical Yearbooks (2016–2023), the Saudi Health Interview Survey 2018, and World Health Organization (WHO) Global Burden of Disease estimates. Hernia repair procedures were categorized by the type, surgical approach, and administrative region. Modifiable risk factors were analyzed among hernia patients compared to the general adult population. Descriptive statistics and comparative analyses were performed. Reporting followed Strengthening the Reporting of Observational Studies in Epidemiology guidelines.

RESULTS: Annual hernia repair procedures increased from 38,200 in 2016 to 45,500 in 2023 (rate: 107–130 per 100,000 population), representing a 19.1% increase. Inguinal hernias constituted 67.9% of all repairs, followed by incisional/ventral hernias (19.1%) and umbilical hernias (9.0%). The male-to-female ratio for inguinal hernia was 7.8:1. The obesity prevalence among hernia patients (41.3%) significantly exceeded that among the general adult population (34.2%). Type 2 diabetes mellitus (28.4% vs. 17.8%), current smoking (19.2% vs. 13.1%), and chronic obstructive pulmonary disease (13.7% vs. 7.9%) were all significantly more prevalent in hernia patients. Laparoscopic repair increased from 27.8% to 52.4% for inguinal hernia over the study period, with substantially lower surgical site infection rates compared to open repair (1.4% vs. 3.8%). Northern border regions demonstrated the lowest procedure rates and highest complication rates nationally.

CONCLUSIONS: Abdominal wall hernia repair procedures are increasing in Saudi Arabia alongside the rising prevalence of modifiable risk factors, particularly obesity and type 2 diabetes mellitus. Preventive strategies targeting obesity reduction, glycemic optimization, and smoking cessation, combined with equitable expansion of laparoscopic repair capacity, represent priority interventions to reduce hernia burden and surgical complications.

Keywords:

Abdominal wall hernia, epidemiology, inguinal hernia, laparoscopic repair, modifiable risk factors, Saudi Arabia

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Introduction

Abdominal wall hernias constitute one of the most prevalent surgical conditions worldwide, accounting for approximately 20 million repairs annually.[1] Inguinal hernias represent the most common type, comprising 70%–75% of all hernia repairs globally, followed by incisional, umbilical, and femoral hernias.[2] The global age-standardized incidence of abdominal wall hernias has increased substantially over the past two decades, driven by aging populations, rising obesity prevalence, and increasing rates of antecedent abdominal surgery.[3]

The pathogenesis of abdominal wall hernias is multifactorial, involving nonmodifiable determinants (age, sex, genetic predisposition, and connective tissue disorders) alongside modifiable risk factors amenable to preventive intervention.[4] Obesity increases intra-abdominal pressure and impairs fascial integrity, elevating hernia risk by two- to three-fold and predisposing to postoperative wound complications.[5] Smoking adversely affects collagen synthesis and tissue healing, contributing to both primary hernia development and postoperative recurrence.[5] Chronic obstructive pulmonary disease (COPD) and other conditions associated with elevated intra-abdominal pressure compound hernia formation risk, while diabetes mellitus impairs wound healing and increases susceptibility to surgical site infection (SSI), a major driver of incisional hernia formation following laparotomy.[6]

Saudi Arabia carries a substantial burden of these modifiable risk factors. National surveys report the adult obesity prevalence to be exceeding 33%, among the highest globally, reflecting profound nutritional transition over recent decades.[7] The prevalence of type 2 diabetes mellitus is approximately 18% in Saudi adults, substantially higher than global averages.[8] Tobacco use, while lower than that observed in Western populations due to sociocultural factors, has increased among younger demographic groups, with current smoking affecting approximately 13% of adults.[9] Collectively, these trends project a growing surgical burden of abdominal wall hernias; yet population-level epidemiological analyses characterizing hernia procedure trends, modifiable risk factor profiles, and geographic distributions in Saudi Arabia are absent from the published literature, in contrast to other high-burden settings.[10]

Understanding hernia epidemiology within a preventive medicine framework is essential for several reasons. First, identifying modifiable risk factor profiles enables preoperative optimization pathways capable of reducing complications and recurrence. Second, documenting regional disparities allows targeted workforce planning and resource allocation. Third, temporal trend analysis informs projections of future surgical demand critical for health system planning aligned with Saudi Vision 2030 health transformation objectives.[11] This study aims to characterize the abdominal wall hernia burden in Saudi Arabia using national hospital discharge data and health survey data (2016–2023), with specific objectives to (1) describe temporal trends in hernia repair procedure rates by type; (2) analyze the prevalence and distribution of modifiable risk factors among hernia patients; (3) assess geographic and urban–rural variations; (4) compare laparoscopic versus open repair adoption and associated outcomes; and (5) identify priority areas for preventive and quality improvement interventions.

Materials and Methods

Study design

This cross-sectional descriptive study analyzed secondary data on abdominal wall hernia repair procedures and associated risk factors from 2016 to 2023, utilizing national hospital discharge records, national health surveys, and international surveillance databases.

Ethics statement

This study utilized publicly available aggregate surveillance data and published de-identified datasets. No individual patient data were accessed. Data sources comprised the following: (1) aggregated population-level statistics from the Saudi Ministry of Health Annual Statistical Yearbooks with open-access publication; (2) de-identified aggregate data from the Saudi Health Interview Survey (SHIS) with prior institutional review board approval; and (3) World Health Organization (WHO) Global Burden of Disease estimates representing publicly available population-level data. As this study involved only secondary analysis of publicly available aggregated data without human subject contact or access to identifiable information, it was exempt from institutional review board approval per national research ethics guidelines. The study adhered to Declaration of Helsinki principles.

Data sources

Data were obtained from three primary sources: (1) Saudi Ministry of Health Annual Statistical Yearbooks (2016–2023), providing hospital discharge data on surgical procedures classified by International Classification of Diseases, 10th Revision (ICD-10) codes for abdominal wall hernia repair[12]; (2) the 2018 SHIS, a nationally representative household survey of 10,735 adults providing prevalence estimates for modifiable risk factors including obesity, type 2 diabetes mellitus, smoking, and COPD, with a hernia patient subgroup identified by self-reported hernia diagnosis or prior repair[13]; and (3) WHO Global Burden of Disease 2019 estimates for inguinal,

femoral, incisional, and other abdominal wall hernias, enabling regional and international benchmarking.[3]

Variables and definitions

Hernia repair procedures were identified using ICD-10 procedure codes for inguinal hernia repair (K40), femoral hernia repair (K41), umbilical hernia repair (K42), ventral/incisional hernia repair (K43), and other abdominal wall hernia repairs (K45–K46).[14] Annual hernia repair rates were expressed per 100,000 population using mid-year population estimates from the General Authority for Statistics.[13] The surgical approach was classified as laparoscopic or open based on procedure coding in Ministry of Health discharge records.[12]

SSI was defined per Saudi Patient Safety Center criteria: infection occurring within 30 days of the index procedure, involving the incision, and requiring antibiotic treatment or reoperation.[12] Thirty-day all-cause readmission and 1-year hernia recurrence requiring reoperation were extracted from administrative data.[12]

Modifiable risk factors were defined as follows: obesity (body mass index: ≥ 30 kg/m^2), type 2 diabetes mellitus (self-reported physician diagnosis or fasting glucose: ≥ 7.0 mmol/L), current smoking (self-reported daily or occasional cigarette use), and COPD (self-reported physician diagnosis with spirometry confirmation in a subset).[13] Geographic regions were classified per Ministry of Health administrative divisions: Central, Western, Eastern, Southern, and Northern/Border regions.[12] Urban areas were defined as cities with a population exceeding 100,000; rural areas had communities below 100,000.[13]

Study size

National analysis utilized population-based data covering approximately 35 million residents. The SHIS sample included 10,735 adults providing nationally representative risk factor estimates; 892 respondents reported a hernia diagnosis or prior hernia repair, constituting the hernia patient subgroup for risk factor analysis. No sample size calculation was required for this descriptive surveillance study.

Statistical methods

Descriptive statistics characterized the procedure trends and risk factor distributions. Annual hernia repair rates per 100,000 population with 95% confidence intervals were calculated. Temporal trends were described narratively with graphical presentation. Risk factor prevalences among hernia patients and the general adult population were compared using proportions and chi-square tests, with statistical significance defined at $P < 0.05$. Laparoscopic adoption rates over time and associated SSI rates were described and compared by the surgical approach. Regional analyses described geographic variation in procedure rates and complication rates. No multivariate analysis was performed given the descriptive study design. Microsoft Excel 2019 was used for analyses.

Reporting guidelines

This study followed Strengthening the Reporting of Observational Studies in Epidemiology guidelines for cross-sectional observational studies.[15]

Results

Participants and descriptive data

The 2023 National Hospital Discharge database recorded 45,500 hernia repair procedures, corresponding to a rate of 130 per 100,000 population.[12] The total number of annual procedures increased from 38,200 in 2016 (107 per 100,000) to 45,500 in 2023, representing a 19.1% increase over the study period.[12] The SHIS hernia subgroup comprised 892 respondents (8.3% of total SHIS sample) with a self-reported hernia diagnosis or prior hernia repair. Of these, 721 (80.8%) were male and 171 (19.2%) were female; 631 (70.7%) resided in urban areas and 261 (29.3%) in rural areas.[13]

Temporal trends in hernia repair procedures

Table 1 presents annual hernia repair procedures by type for 2016–2023. Inguinal hernia repairs constituted the largest proportion throughout the study period, ranging from 67.3% to 67.9% of all repairs, followed by incisional/ventral hernias (18.9%–19.1%), umbilical hernias (9.0%–9.7%), and other types (3.9%–4.5%). The total

Table 1: Annual abdominal wall hernia repair procedures by type in Saudi Arabia (2016–2023)

Hernia type	2016	2018	2020	2022	2023	% of total (2023)
Total number of procedures (*n*)	38,200	40,800	36,200	43,900	45,500	100
Rate per 100,000	107	111	96	123	130	–
Inguinal hernia	25,700	27,600	24,300	29,700	30,900	67.9
Incisional/ventral hernia	7300	7700	6900	8400	8700	19.1
Umbilical hernia	3500	3900	3400	4100	4100	9.0
Other/unspecified	1700	1600	1600	1700	1800	4.0
Laparoscopic rate—inguinal	27.8%	35.2%	38.6%	48.3%	52.4%	–

n = absolute number of procedures.
Data source: Saudi Ministry of Health Annual Statistical Yearbooks (2016–2023).
2020 values reflect the impact of COVID-19 pandemic with procedural recovery by 2022–2023

number of procedures increased steadily, with a transient decline in 2020 coinciding with the COVID-19 pandemic (36,200 procedures; −11.3% relative to 2019 estimates), followed by full recovery by 2022.[12] Figure 1 illustrates the temporal trends in hernia repair procedure rates by type, with a secondary axis displaying laparoscopic adoption rates. The mean age at repair was 48.2 years for inguinal hernias and 54.7 years for incisional hernias.[12] The male-to-female ratio for inguinal hernia repairs was 7.8:1, while femoral hernia repair demonstrated a female-to-male ratio of 2.4:1.[1]

Modifiable risk factor profile

Table 2 presents modifiable risk factor prevalences among hernia patients compared to the general adult population. The obesity prevalence among hernia patients (41.3%) significantly exceeded that among the general adult population (34.2%; $P < 0.001$). Among the incisional hernia repair subgroup specifically, the highest prevalence of obesity was observed at 52.8%, reflecting the established relationship between elevated body mass index, wound complications, and subsequent incisional hernia formation.[13] Type 2 diabetes mellitus was present in 28.4% of hernia patients versus 17.8% in the general adult population ($P < 0.001$). Current smoking was documented in 19.2% of hernia patients compared to 13.1% of the general population ($P < 0.01$). COPD prevalence was elevated among hernia patients (13.7%) relative to the general adult population (7.9%; $P < 0.001$). The co-occurrence of two or more modifiable risk factors was observed in 34.1% of hernia patients compared to 19.4% in the general population ($P < 0.001$). Figure 2 displays comparative risk factor prevalences between hernia patients and the general adult population.

Laparoscopic versus open repair trends and outcomes

Laparoscopic repair adoption increased from 27.8% of inguinal hernia repairs in 2016 to 52.4% in 2023. For incisional hernia repairs, laparoscopic utilization increased from 18.3% to 41.6% over the same period.[12] SSI rates were significantly lower with laparoscopic compared to open repair procedures for inguinal hernia (1.4% vs. 3.8%; $P < 0.001$) and incisional hernia (2.1% vs. 5.3%; $P < 0.001$). Thirty-day readmission rates were similarly lower following laparoscopic repair (2.2% vs. 4.7%). The one-year hernia recurrence requiring reoperation was 2.1% for laparoscopic repair compared to 6.2% for open repair.

Regional distribution and geographic disparities

Table 3 presents hernia repair procedure rates, laparoscopic adoption, SSI rates, and 30-day readmission rates by administrative region in 2023. The Central region (Riyadh) demonstrated the highest procedure rate (148 per 100,000) and highest laparoscopic adoption (61.2%), reflecting its tertiary referral function and concentration of specialized surgical units.[12] The Western region (Makkah, Madinah, and Jeddah) recorded the procedure rate of 142 per 100,000, with 58.7% laparoscopic adoption. In contrast, Northern Border regions demonstrated the lowest procedure rate (89 per 100,000), the lowest laparoscopic adoption (28.9%), and the highest SSI rate (6.1%), suggesting access disparities and suboptimal perioperative quality in remote facilities.[12] Urban facilities demonstrated laparoscopic

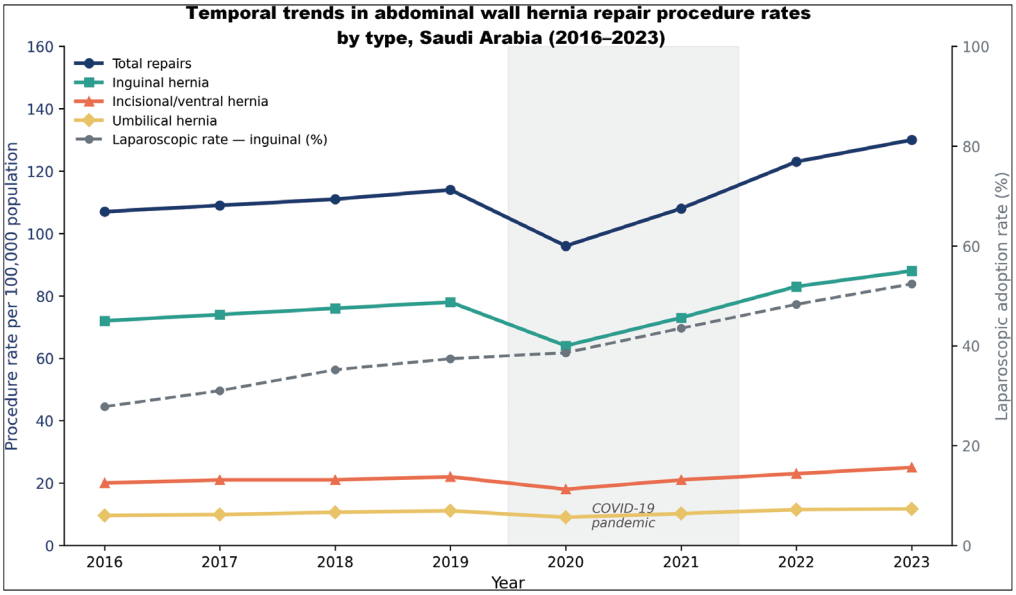


Figure 1: Temporal trends in abdominal wall hernia repair procedure rates by type, Saudi Arabia (2016–2023). Line graph shows the annual procedure rates per 100,000 population (left vertical axis) for total hernia repairs, inguinal hernia, incisional/ventral hernia, and umbilical hernia. A secondary right vertical axis displays the laparoscopic repair adoption rate for inguinal hernia (dashed line), showing a progressive increase from 27.8% (2016) to 52.4% (2023). A notable transient decline was observed across all hernia types during the COVID-19 pandemic (2020), with recovery by 2022–2023. The horizontal axis displays study years (2016–2023)

Table 2: Prevalence of modifiable risk factors among hernia patients versus the general adult population, Saudi Arabia 2018

Risk factor	Hernia patients (*n* = 892) (%)	General adult population (*n* = 10,735) (%)	Difference (pp)	*P* value
Obesity (BMI: ≥ 30 kg/m²)	41.3	34.2	+7.1	< 0.001
Type 2 diabetes mellitus	28.4	17.8	+10.6	< 0.001
Current smoking	19.2	13.1	+6.1	< 0.01
COPD/chronic respiratory disease	13.7	7.9	+5.8	< 0.001
≥ 2 co-occurring risk factors	34.1	19.4	+14.7	< 0.001
Obesity—incisional hernia subgroup	52.8	–	–	–

BMI = body mass index, COPD = chronic obstructive pulmonary disease, pp = percentage points.
Data source: Saudi Health Interview Survey 2018; hernia subgroup defined by self-reported hernia diagnosis or prior hernia repair.
P values from chi-square tests comparing hernia patient proportions to general adult population proportions

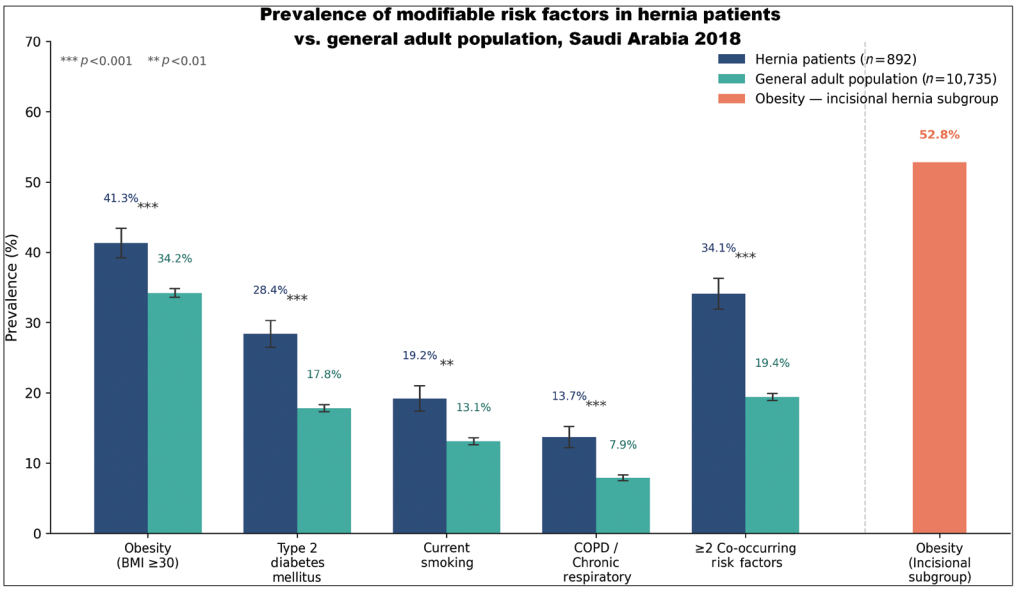


Figure 2: Prevalence of modifiable risk factors among hernia patients versus the general adult population, Saudi Arabia 2018. Grouped bar chart displays prevalence percentages (vertical axis, 0%–60%) for five categories (horizontal axis): obesity, type 2 diabetes mellitus, current smoking, chronic obstructive pulmonary disease, and co-occurrence of ≥2 risk factors. Two adjacent bars per category: hernia patients (dark shading, *n* = 892) and general adult population (light shading, *n* = 10,735). All between-group differences are statistically significant. An additional single bar for obesity prevalence in the incisional hernia subgroup (52.8%) is displayed separately at right. Error bars represent 95% confidence intervals

adoption of 58.3% versus 31.7% in rural facilities, alongside substantially lower SSI rates (2.4% urban vs. 5.1% rural) and lower 30-day readmission rates (2.9% urban vs. 5.8% rural) [Figure 3].[12]

Discussion

Key results

This analysis reveals a progressive 19.1% increase in abdominal wall hernia repair procedures in Saudi Arabia from 2016 to 2023, accompanied by a substantial shift toward laparoscopic repair that now comprises more than half of inguinal hernia repairs nationally.[12] Modifiable risk factors—particularly obesity and type 2 diabetes mellitus—are significantly more prevalent among hernia patients than among the general adult population, identifying clear opportunities for prevention-oriented intervention. Marked geographic and urban–rural disparities in procedure rates, laparoscopic adoption, and SSI rates indicate inequities in access to quality surgical care requiring a targeted policy response.

Interpretation and implications

The 19.1% increase in hernia repair procedures reflects converging demographic and epidemiological trends: population growth, aging, and rising prevalence of modifiable risk factors, particularly obesity.[7] With the adult obesity prevalence in Saudi Arabia exceeding 34% and continuing to increase in alignment with the global trajectories of nutritional transition, the surgical burden of abdominal wall hernias is projected to increase correspondingly.[7] The markedly elevated obesity prevalence among hernia patients (41.3% overall; 52.8% for incisional hernia) reinforces obesity as a key modifiable determinant of both hernia occurrence and postoperative complications.[5]

Table 3: Regional distribution of hernia repair procedures and surgical outcomes in Saudi Arabia, 2023

Administrative region	Procedure rate (per 100,000)	Laparoscopic rate (%)	SSI rate (%)	30-day readmission (%)
Central (Riyadh)	148	61.2	1.9	2.1
Western (Makkah/Madinah)	142	58.7	2.3	2.6
Eastern	126	53.4	2.8	3.1
Southern (Asir/Jazan)	112	41.8	4.4	4.9
Northern (Tabuk/Al-Jouf)	103	34.2	5.2	5.6
Border regions	89	28.9	6.1	6.8
National average	130	52.4	3.1	3.5

SSI = surgical site infection.
Data source: Saudi Ministry of Health Annual Statistical Yearbook 2023.
SSI defined per Saudi Patient Safety Center criteria; 30-day readmission includes all-cause readmissions following index hernia repair; Border regions include areas adjacent to Yemen, Jordan, and Iraq

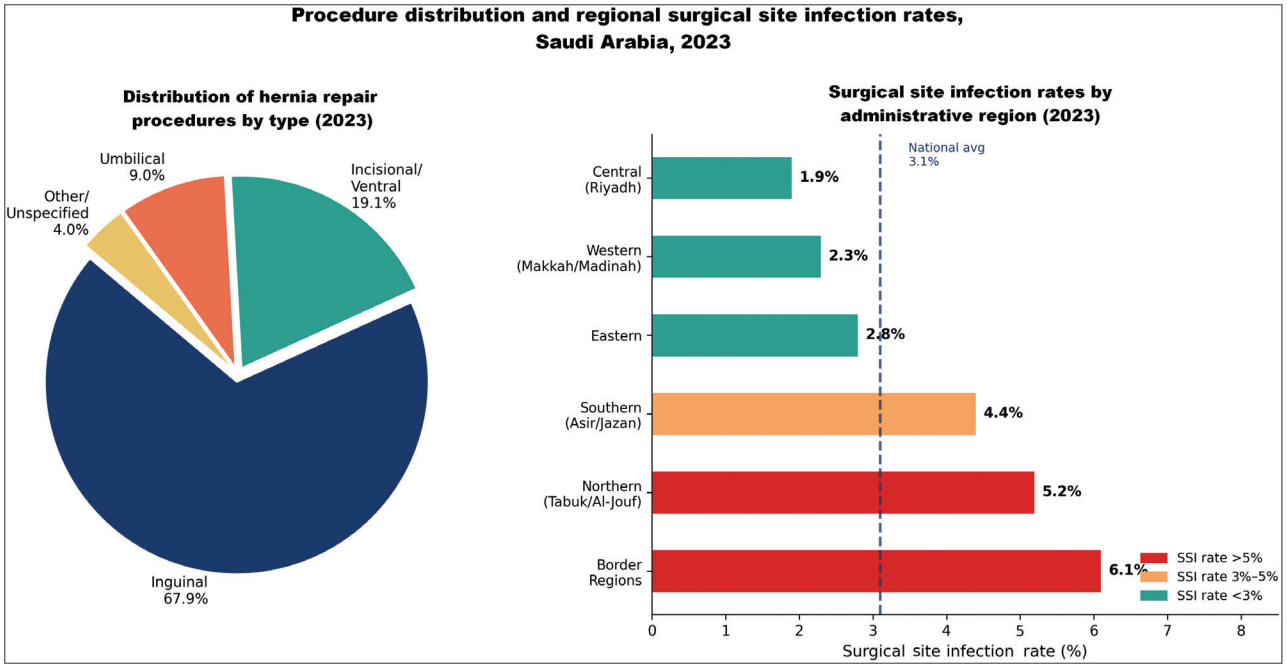


Figure 3: Distribution of hernia repair procedures by type and regional surgical site infection rates in Saudi Arabia, 2023. Left panel: Pie chart displaying the proportional distribution of all hernia repair procedures by type—inguinal (67.9%), incisional/ventral (19.1%), umbilical (9.0%), and other/unspecified (4.0%). Right panel: Horizontal bar chart displaying SSI rates by administrative region (horizontal axis: 0%–7% scale), arranged in the descending order from Border regions (highest: 6.1%) to the Central region (lowest: 1.9%). National average displayed as a vertical reference line at 3.1%. Color coding: green bars <3%, yellow bars 3%–5%, red bars >5%. Both panels based on 2023 Ministry of Health data (*n* = 45,500 procedures)

The elevated type 2 diabetes mellitus prevalence among hernia patients (28.4% vs. 17.8% in the general population) has critical implications for perioperative risk stratification and surgical pathway design.[8] Diabetes impairs fascial healing, increases SSI susceptibility, and contributes to hernia recurrence following repair. Glycemic optimization protocols integrated into hernia repair pathways—with standardized preoperative glycated hemoglobin thresholds and endocrinology co-management—represent evidence-based preventive interventions that merit systematic implementation across hernia repair centers.[6] The higher smoking prevalence among hernia patients (19.2% vs. 13.1%) aligns with the established evidence that smoking compromises collagen metabolism and tissue integrity, increasing both hernia risk and long-term repair failure.[5] Structured smoking cessation programs as components of surgical prehabilitation pathways could reduce SSI rates and improve long-term recurrence outcomes.

The substantial increase in laparoscopic repair adoption from 27.8% to 52.4% for inguinal hernia represents a positive quality improvement trajectory directly associated with lower SSI, readmission, and recurrence rates in this analysis.[12] However, the persistent urban–rural gap in laparoscopic adoption (58.3% urban vs. 31.7% rural) indicates inequitable access to minimally invasive surgical expertise, likely contributing to the higher rural SSI and readmission rates observed. Targeted laparoscopic training programs for rural general surgeons and telesurgical mentorship pathways warrant consideration under the

Ministry of Health's ongoing health transformation agenda.[11]

Comparison with other settings

Saudi Arabia's 2023 hernia repair rate of 130 per 100,000 falls within the range reported for comparable high-income countries (100–200 per 100,000), though below European benchmarks of 160–210 per 100,000.[1,3] Comparatively lower rates likely reflect a combination of diagnostic underreporting, access barriers in rural and border regions, and genuine epidemiological differences. The 52.4% laparoscopic adoption rate for inguinal hernia compares favorably with the global average of approximately 40% but remains below European Hernia Society guideline benchmark, where laparoscopic rates exceed 60%–70% in high-volume centers.[16] The open repair SSI rate of 3.8% is consistent with the reported global rates of 3%–5% for inguinal hernia, while the laparoscopic SSI rate of 1.4% falls within the 1%–2% range reported in the literature.[6]

The obesity prevalence among hernia patients (41.3%) aligns with findings from comparable high hernia-burden settings reporting 38%–45% obesity rates in surgical hernia populations, consistent with global evidence linking nutritional transition to increased hernia incidence.[17] The higher diabetes prevalence in Saudi hernia patients (28.4%) exceeds that observed in comparable Western hernia surgery cohorts that typically report a prevalence of 15%–20%, reflecting Saudi Arabia's substantially higher national diabetes burden.[8] The proportion of districts with laparoscopic adoption below 40% (Northern Border and parts of Southern regions) contrasts with leading hernia programs where minimally invasive techniques are universally available, underscoring the equity gap.[18]

Strengths and limitations

The primary strengths of this study include the use of nationally representative data spanning 8 years, enabling trend analysis and pandemic impact evaluation. The integration of administrative procedure data with household survey risk factor estimates provides complementary methodological perspectives. The large SHIS sample (10,735 adults) with an identifiable hernia subgroup (892 respondents) provides reasonable statistical precision for risk factor comparisons. Multi-year data enable the assessment of laparoscopic adoption trajectories and COVID-19 system impacts.

The important limitations include potential undercounting of hernia repairs due to incomplete capture of private-sector facilities in Ministry of Health administrative data, which may be particularly pronounced in urban areas.[12] The reliance on self-reported hernia diagnoses in the SHIS introduces potential recall and ascertainment bias; hernia diagnoses were not clinically verified in survey respondents. The cross-sectional design precludes causal inference regarding risk factor–hernia relationships or temporal attribution of associations. District-level data aggregation may mask within-district inequities in procedure rates and outcomes. Administrative denominator estimates may be imprecise in border regions due to population mobility and unregistered migrant workers. Private-sector laparoscopic adoption data were incompletely captured, potentially underestimating the national laparoscopic rates.

Future research directions

The priority research areas include the following: prospective cohort studies examining the impact of structured preoperative obesity management and glycemic optimization on hernia recurrence and SSI rates; geospatial mapping of hernia procedure rates relative to obesity and diabetes prevalence at the district level to identify high-burden underserved communities; cost-effectiveness analysis of laparoscopic surgical training program expansion for rural facilities; qualitative investigation of barriers to hernia care-seeking in rural and border regions; evaluation of prehabilitation program effectiveness incorporating smoking cessation and physical conditioning in hernia repair candidates; and interrupted time-series analysis of specific quality interventions such as enhanced recovery after surgery protocol implementation on length of stay and complication rates.

Policy implications

Reducing the modifiable risk factor burden driving hernia incidence and surgical complications requires multisectoral preventive strategies extending beyond the surgical episode. Obesity reduction aligned with Saudi Vision 2030 health transformation targets—physical activity promotion, healthy dietary environments, and expansion of bariatric surgery access where indicated—would concurrently reduce hernia incidence and improve perioperative surgical outcomes.[11] Preoperative optimization pathways incorporating standardized glycemic control targets, structured smoking cessation programs, and nutritional assessment should be standardized across all Ministry of Health hernia repair centers, with primary care integration enabling risk factor identification and referral well before surgical presentation.

Addressing laparoscopic adoption disparities requires systematic investment in surgical training infrastructure, particularly for rural and border region facilities. Mandatory laparoscopic hernia repair competency requirements as part of general surgery specialist training standards, supported by simulation-based

training centers at regional hospitals, could accelerate national uptake. Mobile surgical teams providing scheduled laparoscopic hernia repair services in underserved regions, analogous to mobile primary care models deployed in other specialties, represent a cost-effective short-term strategy.[11] Telesurgery mentorship programs linking high-volume urban hernia centers with rural facilities could sustainably build technical capacity.

The COVID-19 pandemic demonstrated that hernia surgical services are vulnerable to healthcare system disruption, with an 11.3% procedural decline in 2020.[12] Robust catch-up surgery protocols prioritizing symptomatic and complicated hernias should be incorporated into future pandemic-preparedness plans. Regional performance benchmarking with transparent public reporting of facility-level SSI rates, laparoscopic adoption rates, and readmission rates would create accountability mechanisms incentivizing quality improvement. The integration of hernia surgical outcome indicators into the national Patient Safety Center quality dashboard, aligned with Ministry of Health transformation program monitoring frameworks, would enable real-time national performance surveillance.[11]

Conclusions

Abdominal wall hernia repair procedures in Saudi Arabia increased by 19.1% between 2016 and 2023, driven by demographic growth and increasing modifiable risk factor prevalence, particularly obesity and type 2 diabetes mellitus. Modifiable risk factors are substantially more prevalent among hernia patients than among the general adult population, identifying clear targets for prevention-oriented preoperative optimization and population-level chronic disease management strategies. Laparoscopic repair adoption has increased substantially and is associated with significantly lower SSI, readmission, and recurrence rates, yet marked urban–rural and regional disparities in minimally invasive surgical access persist. Northern border and rural populations experience the lowest procedure rates and highest complication rates, warranting targeted surgical capacity and workforce strengthening interventions. Findings provide the first national epidemiological baseline characterizing hernia burden and modifiable risk factors in Saudi Arabia, informing program planning, preventive strategy development, and monitoring of progress toward equitable, high-quality hernia surgical care aligned with Saudi Vision 2030 health transformation objectives.

Author contributions

AAA: conceptualization, data curation, formal analysis, methodology, writing—original draft, and writing—review and editing.

Ethical policy and Institutional Review Board statement

This study involved only secondary analysis of publicly available aggregated and de-identified data without human subject contact or access to identifiable information; it was exempt from Institutional Review Board approval as per the Law of Ethics of Research on Living Creatures, issued by Royal Decree No. M/59 (14/09/1431 AH), and its Implementing Regulations, as enforced by the National Committee of Bioethics (NCBE) in the Kingdom of Saudi Arabia, which exempt secondary analyses of publicly available, non-identifiable aggregated data from prospective board review. The study adhered to Declaration of Helsinki principles.

Declaration of patient consent

The requirement for individual informed consent was waived because this study used only publicly available, de-identified, and aggregated data, and did not involve any direct contact with human subjects or the collection of personal identifiable information.

Data availability statement

The data supporting this study are derived from publicly available sources: the Saudi Ministry of Health Annual Statistical Yearbooks (2016–2023), available at website moh.gov.sa; the SHIS 2018, available through the General Authority for Statistics at website stats.gov.sa ; and WHO Global Burden of Disease 2019 estimates, available at website healthdata.org/gbd . No primary data were collected. All data used in this analysis are available to qualified researchers upon direct request to the respective national authorities.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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